

MULTIMEDIA



UNIVERSITY

STUDENT ID NO

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# MULTIMEDIA UNIVERSITY

## FINAL EXAMINATION

TRIMESTER 3, 2016/2017

**PMT0101 – MATHEMATICS I**

(All sections / Groups)

26 MAY 2017

3:00 p.m. – 5:00 p.m.

(2 Hours)

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### INSTRUCTIONS TO STUDENT

1. This question paper consists of six pages with **FIVE** questions.
2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the answer booklet provided.
4. **No calculators are allowed.**
5. **You are required to write proper steps.**

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**QUESTION 1 [10 marks]**

- (a) Simplify the expression and write your final expression as a fraction with no negative exponents. Assume all variables have nonzero values.

$$\left(\frac{-2xy^{-2}}{y^3}\right)^2 \cdot \left(\frac{x^{-4}}{4y^2}\right) \quad [2 \text{ marks}]$$

- (b) Rationalize the denominator for  $\frac{1-\sqrt{5}}{1+2\sqrt{5}}$  and simplify. [2 marks]

- (c) Simplify the following expression and write your final expression as a single term. Assume all variables have positive values.

$$-3y\sqrt{\frac{4x^2}{3}} + 2\sqrt{3x^2y^2} \quad [2 \text{ marks}]$$

- (d) Factor the polynomial completely.

$$5xy^2 - 7xy - 6x \quad [2 \text{ marks}]$$

- (e) Express  $\frac{3+2i}{2-3i}$  in the form  $a+bi$ , where  $a$  and  $b$  are real numbers. [2 marks]

**Continued .....**

**QUESTION 2 [10 marks]**

- (a) Factor  $x^3 - x^2 - 4x + 4$  completely.

Then use your result to solve the following equation.

$$x^3 - x^2 - 4x + 4 = 0 \quad [2.5 \text{ marks}]$$

- (b) Solve the equation  $x - 4 = \sqrt{3x - 8}$ . Remember to check your answers.

[3 marks]

- (c) Solve  $1 \leq \frac{2x-1}{-3} \leq 5$ . Give your final answer in interval notation.

[2 marks]

- (d) Solve the equation  $|4x - 3| = 13$

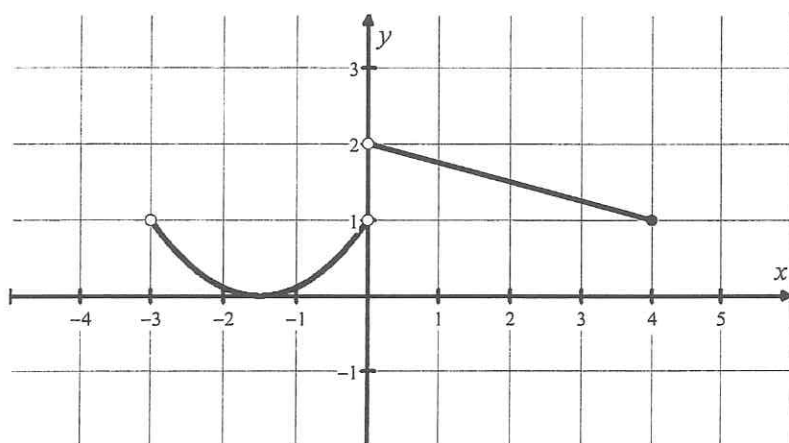
[2.5 marks]

**Continued .....**

**QUESTION 3 [10 marks]**

(a) The figure shows the graph of a function.

(The axes are marked off in one-unit intervals.)



(i) State the domain and the range of the function in interval notation.

(ii) State whether it is a one-to-one function.

[2 marks]

(b) Given the functions  $f(x) = \sqrt{3+x}$  and  $g(x) = \frac{6}{4x+1}$ , find

(i)  $(f \circ g)(6)$ , giving your final answer in the form  $\frac{m}{n}$  where  $m$  and  $n$  are integers.

(ii)  $f^{-1}(x)$ , as a polynomial in  $x$ .

[3 marks]

(c) Given a polynomial function  $f(x) = 2x^3(x-4)^2(x+1)$ .

(i) What is the degree of  $f$ ?

(ii) Find the zeros of  $f$  and their multiplicities.

At each zero, determine whether the graph of  $f$  crosses or touches the  $x$ -axis.

(iii) Find the  $y$ -intercept of the graph of  $f$ .

(iv) Determine the end behavior of  $f$ .

(v) Sketch the graph of the function  $f$ .

Make sure your graph shows all intercepts and exhibits the proper end behaviour.

[5 marks]

Continued .....

**QUESTION 4 [10 marks]**

- (a) Use long division to find the quotient and the remainder when the polynomial  $3x^3 - 2x^2 + 10x - 7$  is divided by  $x^2 + 3$ .  
You are required to state clearly what the quotient and the remainder are. [3 marks]

- (b) Solve the equation  $8^{3x-1} = 4^{2x+3}$ . [2 marks]

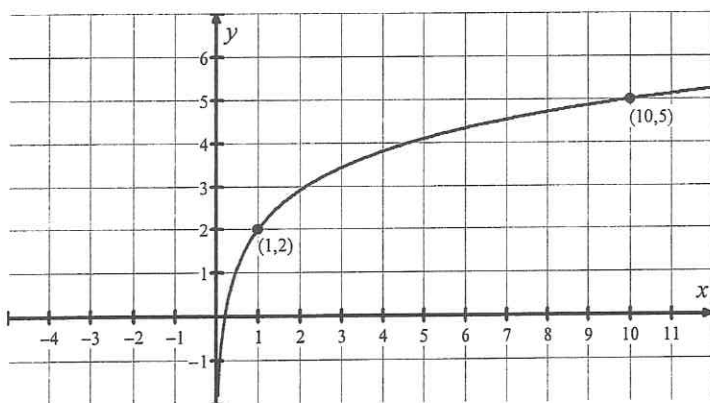
- (c) Given  $h(x) = -2\left(\frac{1}{3}\right)^x + 1$ .  
Find the value of  $m$  such that  $h(m) = 53$ . [1 mark]

- (d) Express the following expression as a single natural number. Show proper steps.

$$2\log_{10} 5 + \log_{10} 12 - \log_{10} 3$$

[2 marks]

- (e) The graph of  $y = a + k \log_{10} x$  passes through points (1, 2) and (10, 5).



Find the values of  $a$  and  $k$ .

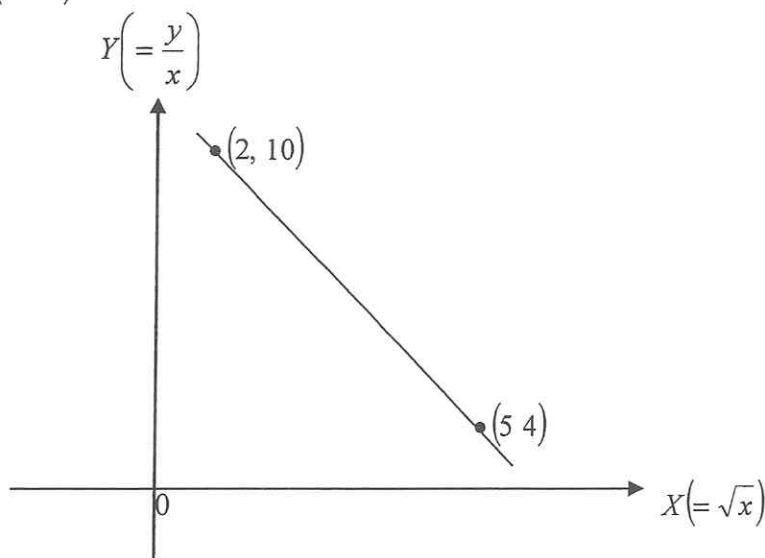
[2 marks]

**Continued .....**

**QUESTION 5 [10 marks]**

- (a) Given an equation of a circle  $x^2 - 4x + y^2 + 8y - 5 = 0$ .
- (i) Express the equation in the form  $(x - h)^2 + (y - k)^2 = r^2$  where  $h$ ,  $k$  and  $r$  are constants.
- (ii) Find the centre and radius of the circle. [2.5 marks]
- (b) Find an equation of a line that contains the point  $(-1, 2)$  and is perpendicular to the line  $x + 3y = 6$ .  
Write your final answer in the form  $y = mx + b$ . [2.5 marks]
- (c) Find an equation of the locus of a moving point  $P(x, y)$  which is always equidistant from points  $A(-2, 3)$  and  $B(4, -1)$ . [2 marks]
- (d) Two variables  $x$  and  $y$  are related by an equation  $y = px + qx^{\frac{3}{2}}$ , where  $p$  and  $q$  are constants.

The diagram below shows part of a straight line obtained by plotting  $Y\left(=\frac{y}{x}\right)$  against  $X(=\sqrt{x})$ .



- (i) Rewrite the given equation to express  $\frac{y}{x}$  in terms of  $\sqrt{x}$ .
- (ii) Find the values of  $p$  and  $q$ .

[3 marks]

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